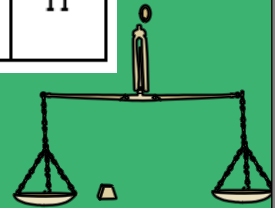
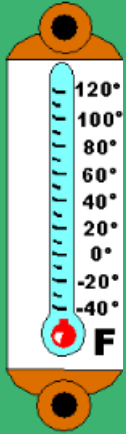


# 1.2 Measuring



Curriculum Outcomes	Related Activities	Page in Text
<ul style="list-style-type: none"> <li>determine accuracy and precision of a measurement</li> <li>demonstrate an understanding of the concerns and issues that pertain to the collection of data</li> </ul>	<ul style="list-style-type: none"> <li>carry out specific measurement activities using an appropriate level of precision</li> </ul>	9
	<ul style="list-style-type: none"> <li>discuss and determine the number of digits students feel confident reading and recording when making the same measurement using scales of different fineness</li> </ul>	9
	<ul style="list-style-type: none"> <li>investigate, through measuring activities, possible inaccuracies that produce different results</li> </ul>	10
	<ul style="list-style-type: none"> <li>relate precision and the number of significant digits for the same measurement</li> </ul>	11
	<ul style="list-style-type: none"> <li>perform measurement calculations and report results with appropriate level of precision and significant digits</li> </ul>	11

## Accuracy

If these shapes are measured multiple times by different people, will everyone find the same measurement?



# Precision

Which ruler will give us a more precise measurement of this shape?



## Notes

**Accuracy:** indicates how close the recorded measurement is to the true value. It is dependent upon the user's skill in using the measuring tool.

**Precision:** is the smallest unit that can be measured with confidence using the measuring tool and is determined by the fineness of the scale on the tool.

### Accuracy

The accuracy of a measurement indicates how close the recorded measurement is to the true value. It depends on the user's skill in using the tool.

When measuring with a ruler, you must start at the 0 mark, and look straight down on the ruler in order to get an accurate measurement.

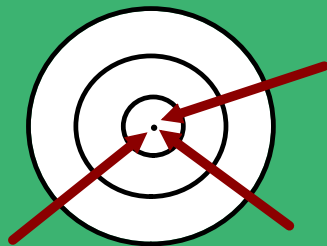
Other factors like temperature, humidity, and the conditions of the tool can also influence accuracy.

### Precision

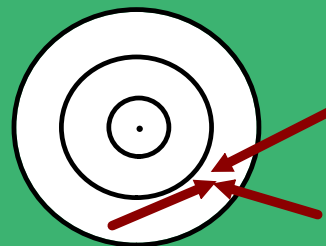
The precision of a measurement is determined by the size of the units that can be measured with confidence using the tool. The smaller the unit, the more accurate the measurement.

## How are accuracy and precision alike and different?

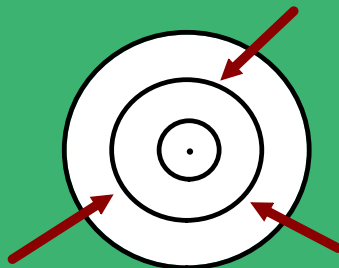
- **Example: Arrows on a target**



Good accuracy  
Good precision



Good precision  
Poor accuracy



Poor precision  
Poor accuracy

### Focus C: Accuracy and Precision

#### Accuracy:

- three different people using same ruler get different answers.

#### Precision:

- greater number of digits increases precision.

#### Classwork:

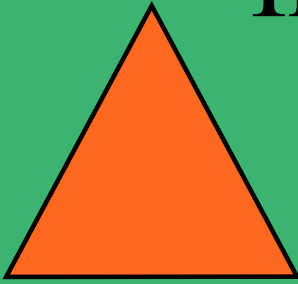
#### Do Focus Questions Pg.9 #2,3,4

#2. It is important to use the same tool to measure length and width because then when you find area your answer will be as precise as both measurements.

#3. 100.0 tells us that the measurement is EXACTLY 100m, while 100m means that it might have been rounded.

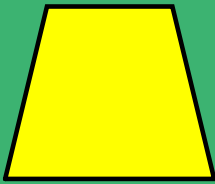
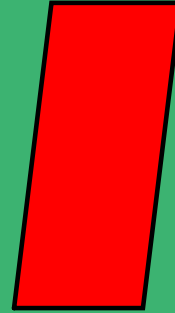
#4. Should the precision of the calculated measurement be considered the same as the least precise measurement???? Explain.

# Investigation



**Perimeter:** Distance around a room or object

**Area:** Space in a room or object = length x width ( $A=lw$ )



Discuss Investigation Questions p.10  
Focus Questions p.11

## Investigation 1

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1. Measure the sides of each of the following polygons, using a **centimetre** ruler. Be as accurate and precise as you can. Record your results below. Compare your results with other members of the class. What do you notice?
  
2. Measure the sides of each of the following polygons, using a **millimetre** ruler. Report each measurement in centimetres. For example, report a measurement such as 82.2 mm as 8.22 cm. Be as accurate and precise as you can. Record your results below. Compare your results with other members of the class. What do you notice?

3. Calculate the area of each of the figures.  
Record your results in the table below.  
Compare your results with other students.  
What do you notice?

Polygon	Area (centimetres)	Area (millimetres)
Rectangle ( $A = l \times w$ )		
Parallelogram ( $A = b \times h$ )		
Triangle ( $A = 0.5 \times b \times h$ )		
Trapezoid ( $A = 0.5 \times h \times (b_1 + b_2)$ )		

4. Which area calculations were more precise: the ones found using the centimetre ruler or the millimetre ruler? Explain.

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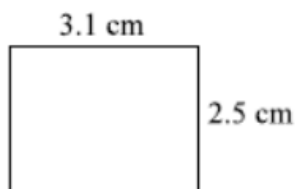


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### Why significant digits?

When you do calculations involving measured values, your answer can only be as precise as the least-precise measured value.

Consider the rectangle below. The length and width (3.1 cm x 2.5 cm) are precise to the tenth of a centimetre. If you calculate the area ( $A = L \times W$ ), the result is expressed in hundredths of a centimetre ( $7.75 \text{ cm}^2$ ). This is a more precise measurement than the original length and width, and is not correct.



So, the area of this rectangle must be expressed as  $7.6 \text{ cm}^2$ .

- \$2 for tomorrow
- Quiz on Tuesday
- Open to where we ended yesterday and be ready to continue copying notes.

Notes			
Significant Digits can help you make decisions regarding the least precise measured value. This process is understood universally.			
<b>Rules for Significant Digits</b>			
1. All nonzero digits (1,2,3,4,5,6,7,8,9) in a measurement are always significant.			
Measurement (cm)	Number of Significant Digits	Measurement (cm)	Number of Significant Digits (fill in answer)
2.45	3	5.7	
34.5678	6	22391	
2.1	2	34993	
3.456	4	2.451	
2. Zeros appearing between nonzero digits are significant.			
Measurement (cm)	Number of Significant Digits	Measurement (cm)	Number of Significant Digits (fill in answer)
1000.0	5	100.38	
20.30	4	10.4	
12.0005	6	200005	
2.01	3	7.004	
3. Zeros appearing in front of all nonzero digits are NOT significant.			
Measurement (cm)	Number of Significant Digits	Measurement (cm)	Number of Significant Digits (fill in answer)
0.0034	2	0.000 000 000 2	
0.000 000 05	1	0.5681	
0.08734	4	0.000438	
0.00405	3	0.00091	
4. Zeros at the end of a number and to the right of the decimal point are significant.			
Measurement (cm)	Number of Significant Digits	Measurement (cm)	Number of Significant Digits (fill in answer)
3.500	4	7.00	3
96.0	3	872.3400	7
5.000	4	48.00	
9.0	2	12.000	
5. Zeros at the end of a number which has no decimal point are NOT significant.			
Measurement (cm)	Number of Significant Digits	Measurement (cm)	Number of Significant Digits (fill in answer)
450	2	34 000 000 000	
82450	4	8 657 480	
5 000 000	1	600	1
983 000	3	32 340 000	

### Copy and Complete:

How many significant digits does each of the following have?

a. 80.1  
b. 990  
c. 36  
d. 0.03

3  
2  
2  
1

e. 5604  
f. 404  
g. 1.023  
h. 0.0120

4  
3  
4  
3

i. 50.0  
j. 50  
k. 69.004  
l. 0.0004

3  
1  
5  
1

m. 908  
n. 1000000  
o. 90060  
p. 985.00

3  
7  
4  
5

If you finish the questions above, work on the following:

Compare the measuring tools which are illustrated on page 7 of your textbook. Answer the following questions.

1. Which tools measure time?

stop watch Big Ben

2. Which tool measures time more precisely?

3. Name another tool which measures time.

score board, hour glass

4. Which tools measure temperature?

therm. temp. gauge

5. Which measures temperature more precisely?

6. How could a person make an error in using an ear thermometer?

not touching the ear

7. Which tool measures mass?

scale

8. Which tool measures volume?

grad. cyl.

9. Which measures more precisely - the scale balance or the graduated cylinder?

the graduated cylinder

10. How could a person make an error when using the graduated cylinder? Would this error affect the accuracy or the precision of the measurement?

not reading at eye level

### Adding and Subtracting

When adding or subtracting your answer can only show as many decimal places as the measurement having the fewest number of decimal places

Examples:

1) 24.6866 m → 4 decimal places

2.343 m → 3 decimal places

+ 3.21 m → 2 decimal places

30.239 m

↓

30.24 m (2 decimal places)

### Multiplying and Dividing

When multiplying and dividing, your answer may only show as many significant digits as the multiplied or divided measurement showing the least number of significant digits.

Examples:

1) 131 m → 3 significant digits

x 2.8 m → 2 significant digits

366.8 m

↓

370 m → 2 significant digits